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Immunonutrition use in post operative critically ill patients

Essay
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Amr mahmoud

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List of Abbreviations

AA	Arachidonic acid
ADMA	Asymmetric Dimethylarginine
ALA	Alpha-linolenic acid
ALI	Acute Lung Injury
ALS	Amyotrophic lateral sclerosis
AMP	Adenosine Monophosphate
ARDS	Acute Respiratory Distress Syndrome
Arg or R	Arginine
ASL	Argininosuccinate Lyase
ASS	Argininosuccinate Synthetase
ATP	Adenosine Triphosphate
BCAA	Branched-chain Amino Acid
BMI	Body Mass Index
cAMP	Cyclic Adenosine MonoPhosphate
CARS	Compensatory Anti-inflammatory Response Syndrome
CCPG	Canadian Clinical Practice Guidelines
CD28	Cluster of Differentiation 28
CHO	Carbohydrate

CI	Confidence Interval
CRP	C-Reactive Protein
CTP	Cytidine triphosphate
DHA	Docosahexanoic acid
DNA	Deoxyribonucleic acid
DON	6-Diazo-5-oxo-L-norleucine
EFAD	Essential Fatty Acid Deficiency
EPA	Eicosapentaenoic acid
eREE	Estimated Resting Energy Expenditure
ESPEN	European Society for Parenteral and Enteral Nutrition
FFA	Free Fatty Acids
GLA	Gamma linolenic acid
Gln or Q	Glutamine
GTP	Guanosine-5-triphosphate
HIV	Human Immunodeficiency Virus
IFN-γ	Interferon gamma
IL	Interleukin
iNOS	Inducible Nitric Oxide Synthase
IVFF	IV Fat Emulsions
LAK	Lymphokine-activated killer
mTOR	Mammalian target of Rapamycin
NK	Natural Killer

NO	Nitric Oxide
NOS	Nitric Oxide Synthase
PA	Pre-albumin
PGE	Prostaglandins
PN	Parenteral Nutrition
REE	Resting Energy Expenditure
RES	Reticuloendothelial System
RNA	Ribonucleic acid
RR	Relative Risk
SCCM/ ASPEN	Society of Critical Care Medicine and American Society of Enteral and Parenteral Nutrition
SIRS	Systemic Inflammatory Response Syndrome
TEE	Total Energy Expenditure
TG	Triglycerides
Th	T-Helper
TNF	Tumour Necrosis Factor
TPN	Total Parenteral Nutrition
UTP	Uridine-5-triphosphate
UVA	University of Virginia

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INTRODUCTION

The potential to modulate the activity of the immune system by interventions with specific nutrients is termed immunonutrition. This concept may be applied to any situation in which an altered supply of nutrients is used to modify inflammatory or immune responses. However, immunonutrition has become associated most closely with attempts to improve the clinical course of critically ill surgical patients, who will often require an exogenous supply of nutrients through the parenteral or enteral routes. **(Grimble et al 2002)**

Critically ill surgical patients are at great risk of adverse outcomes. In these patients complex variable immune and inflammatory changes occur that are only now being well defined. A biphasic response with an early hyperinflammatory response followed by an

excessive compensatory response associated with immunosuppression is seen in many such patients. Here, early treatment is aimed at decreasing the inflammatory response rather than enhancing it, to abrogate the hyperinflammation and prevent the compensatory immunosuppression. **(Calder et al 2002).**

Three potential targets exist for immunonutrition; mucosal barrier function, cellular defence, and local or systemic inflammation. The nutrients most often studied for immunonutrition are arginine, glutamine, branched chain amino acids, GƆ 3 fatty acids, and nucleotides. **(Suchner et al 2002)**

Types of nutritional formulation, routes of delivery, and number of delivered calories all modulate physiologic and pathologic responses and thus affect patient outcome. **(Scurlock C. et al 2008)**

CHAPTER 1:

Pathophysiology Of Immune And Metabolic Alteration In Post Operative Critically Ill Patients

Severe surgical illness results in metabolic responses that mobilize substrate (amino acids and fatty acids) from body stores to support vital organs, enhance resistance to infection, and ensure wound healing. **(Douglas, 2006)**

Central to this process is the redistribution of body protein, which moves from skeletal muscle to support the central viscera. If unsupported, this protein-wasting state could result in prolonged convalescence, diminished immunity, and poor wound healing. **(Douglas, 2006)**

Present evidence suggests that the central nervous system plays a major role in regulating this protein catabolic response. Infusing exceedingly small quantities of the proinflammatory cytokines into the brain can mimic injury responses, and central cytokine blockade may be one therapeutic approach to attenuating these responses safely in the future. Additional evidence also demonstrates that the

function of the hypothalamus and anterior pituitary is dampened during the later stages of severe surgical illness, and the possibility of hormonal replacement therapy needs to be explored. **(Douglas, 2006)**

Immune response in post-operative critically ill patient

The immune status of post operative critically ill patients is by no means homogenous, and these patients have significant differences in underlying immune status that precludes their being ‘‘lumped’’ together. This in turn dictates variations in the immune nutrient profile that is appropriate for each group. **(Marik et al., 2008)**

Both innate and acquired immunity are involved in the response. The innate immune response is characterized by an initial local inflammatory reaction at the site of operation, which involves activation of macrophages and monocytes, the alternate complement pathway,

and the blood coagulation system. **(Matsuda et al., 2006)**

The local inflammatory reaction is amplified through the release of pro-inflammatory mediators (e.g., tumor necrosis factor, interleukin-1, prostaglandins, leukotrienes, thromboxanes) that in turn leads to the systemic inflammatory response syndrome (SIRS). **(Matsuda et al., 2006)**

The initial phase of the SIRS response is felt to be an adaptive process that facilitates resolution of the acute inciting process. However, a maladaptive response secondary to overwhelming or prolonged systemic inflammation (e.g., ‘‘excessive SIRS’’) may ensue as the result of factors such as the type of infecting organism, genetic predisposition to over-expression of inflammatory cytokines, patient age, and co morbidities. **(Matsuda et al., 2006)**

Clinical syndromes associated with excessive SIRS include the following: the acute

respiratory distress syndrome (ARDS), septic shock, disseminated intravascular coagulation, and the multiple organ dysfunction syndrome.

The mechanism for organ dysfunction in the setting of systemic inflammation appears to involve extensive mitochondrial damage resulting from overproduction of nitric oxide and its metabolite peroxynitrite. **(Mizock, 2009)**

Provision of supplemental arginine in the setting of severe sepsis (especially with multiple organ dysfunction) may be deleterious in this regard by further augmenting production of nitric oxide. **(Bansal et al., 2003)**

The adaptive immune response develops several days after the initial innate response and involves the interaction between antigen-presenting cells (e.g., macrophages, dendritic cells) and lymphocytes that are responsible for cell-mediated immunity and antibody production. A transient down regulation of adaptive immunity is commonly seen in patients with acute critical illness that is termed the